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OBJECTIVES

1. Finalize the compositing and gridding scheme for the level 3 vegetation index (VI) products.

2. Work on VI compositing and coding with BRDF dependency.

3. Prepare science data simulation plan for testing of vegetation index algorithms.

4. Prepare for SCAR-B campaign in Brazil.

TASK PROGRESS

1. MODLAND Land Cover and SDST Meetings

A land cover meeting was held in Boston in January to assess product dependencies and to determine how the BRDF, surface reflectance, and vegetation index products might be combined and packaged as a unit to aid in the development and implementation of Land Cover Product. Compositing methodologies and gridding schemes were discussed as were data simulation plans.

In early April a MODLAND - SDST meeting was held near Goddard in which all products and dependencies were discussed. A general consensus was reached with respect to the level 3 vegetation index (VI) products. This product is dependent upon the surface reflectance product and the BRDF product. Thus, the fully composited, cloud-free VI product is seen as an atmospherically corrected and BRDF adjusted field which will result in a temporal series of VI images that are adjusted to nadir with minimal atmospheric variations. Angular and atmospheric variations have caused much noise in the composited NDVI product. These noise factors in turn get passed on to the net primary production (NPP), leaf area index (LAI) and absorbed photosynthetically active radiation (APAR) level 4 products.

The most efficient scenario involves using the BRDF and surface reflectance products to produce nadir-adjusted reflectances on a daily basis. With each temporal acquisition the surface reflectances will be composited by eliminating the most cloud contaminated pixels in favor of cloud-free, close to nadir pixels. The close to nadir pixels are preferred since they would require minimal BRDF adjustment. As the choice of pixels deviates from nadir, the BRDF model is used to extend these pixels to nadir. If the BRDF for this period is questionable or is missing, we would revert back to the maximum value VI with an

appropriate flag.

The VI product can be produced with the ISSCP grid at 270 m minimal spatial resolution. With respect to the improved VI, we have to assess the impact, if any, of using the 500 m 'blue' channel for the atmospheric resistance portion of the VI. We need to make sure we can use an 'enhanced' 250 m blue channel for the 250 m VI product. Included in this discussion is the role of re-sampling and the role of a 10 to 50 km aerosol product in producing the surface reflectances. The SCAR campaigns will provide an excellent opportunity to examine atmospheric correction and residual cloud/ smoke contamination on the VI product.

2. TM-Validation Data Set

Over 20 Landsat TM images have been processed for VI analyses and comparisons. The TM images represent a global set of vegetation conditions in North America, Africa, and Asia and have been resampled to 250 & 500 m MODIS channels and have been Rayleigh corrected. The data are then converted to the normalized difference vegetation index (NDVI), the soil-adjusted vegetation index (SAVI), the atmospherically resistant vegetation index (ARVI), and the modified NDVI (MNDVI). There are many appreciable differences in the response of these VIs to the wide range of vegetation conditions. In particular, the saturation problem of the NDVI is greatly reduced with the SAVI and MNDVI. The on-going analysis includes the use of the dark-object subtraction technique to fully correct the images for atmosphere and the use of a 500 m blue band to produce an enhanced 250 m MNDVI. There is also an attempt being made to obtain estimates of the LAI and biomass conditions of the dominant vegetation in the selected scenes.

3. Walnut Gulch Data Analysis

On going work involves the use of the 1992 Landsat TM temporal data set to assess the ability and sensitivity of the various VIs to capture both spatial and temporal changes in vegetation conditions at Walnut Gulch. Besides the experimental watershed we are also analyzing the TM produced VIs for cross-border vegetation studies throughout the growing season. This temporal TM data set has also been transformed to 250 and 500 m MODIS channels to assess the role of scaling in vegetation sensitivity. The 1991 AVIRIS imagery acquired over Walnut Gulch is also being converted to MODIS channels as is the 1991 ASAS imagery (dry and wet seasons) for BRDF-VI studies.

4. SCAR-B Brazil Experiment

The SCAR-B field experiment is now officially accepted by the Brazilian government with both MAS and AVIRIS included in the

flight plans. The MAS will provide imagery at a +/- 45 degrees scan, providing an opportunity to link the BRDF correction with the VI product generation. The AVIRIS will provide continuous spectra from 0.4 to 2.5 microns, enabling us to simulate MODIS channels, particularly the 'blue', which is needed in the MNDVI and ARVI equations. As part of the land component to the SCAR-B mission, we expect to collect data over different plant communities (forested and non-forested) at various stages of land use conversion, ie., burned, cleared, secondary regrowth, primary forest, etc. The flights will provide us with both clear sky conditions as well as smoke filled, and aerosol laden skies. This offers us the opportunity to truly integrate atmospheric correction and atmospheric-resistance methodologies in vegetation studies. We hope to collect data over particular sites before and after a "controlled burn" as well.

The test sites of interest to us include (1) Alta Floresta (forested and cleared), (2) Brasilia (cerrado); and (3) Rondonia (forested, cleared, and agriculture). My Post-doc, Wim van Leeuwen and I will participate for the entire field campaign and collect three types of measurements;

(1) radiometry of soils, leaves, litter, understory, transmittance, and APAR;
(2) biophysical estimates of LAI, tree cover, green cover, biomass, and architectural parameters; and
(3) nutrient analysis of soils, litter, and leaves, including organic carbon, nitrogen, etc.

All of these measurements would be made at the various forest, cerrado, and land-use converted areas before and after burning and/ or clearing.

5. Asian Land Cover Analysis

Jin Hongtao, student, has been working with AVHRR temporal data (8km pathfinder) to examine the use of multitemporal NDVI data for land cover discrimination in Asia. He is using a temporal mixing model to decompose the temporal signatures into land cover classes. The mixture model works most effectively with 3 land cover classes working simultaneously, thus the 3 nearest "pure" classes (extracted from ecological test sites) are selected for each pixel and an area is mapped as a linear mixture of these three classes. This results in effective definition of transition zones and boundaries and provides a flag if an area cannot be mapped according to the 3 nearest classes, thus defining a fourth class.

Next Quarter Activities

1. I will be attending an ORSTOM -sponsored remote sensing conference at La Serena, Chile from April 24 - 27, 1995. I am an

invited speaker and will present a 45 minute talk entitled "Extension of soil spectra to the satellite: atmosphere, geometric, and sensor considerations". In addition to the conference, I will be visiting some proposed test sites for the "Global Land Cover Test Site (GLCTS)" initiative with Dr. Fernando Santibanez of the University of Chile, Santiago.

2. Jin Hongtao (student) will attend the Geoinformatics '95 Meeting in Hong Kong, May 25 -28, 1995. He will present a paper entitled "Asian Land Cover Mapping Using Temporal AVHRR Data", by Jin Hongtao and Alfredo Huete.

3. Dr. Arnon Karnieli of the Ben Gurion University of the Negev, Israel will visit our lab the first week in June. He will stay 2 weeks during which we will make field measurements on the optical properties of microphytic plant communities both in southern Arizona as well as in Utah. This is a funded effort from the International Arid Lands Consortium to investigate the role of microphytic crusts in influencing the vegetation index signal over arid regions.

4. We will continue to plan and prepare for the Brazil SCAR-B field campaign. A final planning meeting will be held in Brasilia on June 27 - 30, 1995.